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Aerosol and Surface Studies of the African Continent with the Multiangle Imaging SpectroRadiometer (MISR) (Topic 5)

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The Multi-angle Imaging SpectroRadiometer (MISR) instrument aboard the Terra spacecraft began taking data on February 24, 2000. MISR contains nine cameras pointed at fixed along-track directions, and acquires images with view angles at the Earth's surface ranging from 70.5 degrees forward of nadir to 70.5 degrees aftward. Each camera contains four CCD line arrays filtered to blue, green, red, and near-infrared wavelengths, and spatial sampling ranging from 275 m to 1.1 km is obtained over a 400-km swath width. An on-board calibration system consisting of deployable Spectralon panels and a monitoring system of stable photodiodes is used to maintain high radiometric accuracy.

Still in the early phase of MISR data analysis, there is a concentrated effort for aerosol and surface retrieval studies to focus on areas where corroborating in situ and ground-based measurements are readily available. An ideal region for investigation is the continent of Africa during August and September, where in southern Africa the Pietersburg Winter Field Campaign of SAFARI 2000 was carried out under mostly cloud-free conditions. Daily solar photometric measurements of aerosol amount were made at numerous AERONET sites in southern Africa, supplemented by solar photometric measurements and surface reflectance measurements at selected targets made by the MISR validation team. With these kinds of data available, it is then possible to assess in some measure the accuracy of the MISR aerosol and surface reflectance products.

The MISR standard algorithm for retrieving aerosol amount over land uses empirical orthogonal functions (EOFs), derived from scene contrast at the different view angles, to describe the component of the radiance at the top-of-atmosphere (TOA) which has the surface-reflected radiance as its source function. Land aerosol results using this algorithm and ocean and coastal water aerosol results will be shown for Africa and its surrounding waters. Comparisons with ground-based sun photometry measurements, where available, will also be presented.

Once the aerosol properties are estimated, the MISR TOA measurements are atmospherically corrected to obtain the surface-leaving radiance. The surface science products generated from these radiances include spectral directional reflectances, land spectral and short-wave albedos, NDVI, and bidirectional reflectance factor (BRF) parameters obtained by fitting directional reflectances to a modified version of the Rahman-Pinty-Verstraete BRF model. Maps of these products over the African landscape and examples of BRFs for coastal waters will be shown.